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HIGH PANEL EXPLOITATION OF HEVEA BRASILIENSIS (MUELL.ARG.): A COMPARATIVE STUDY OF FIVE TAPPING SYSTEMS

AHMAD ZARIN BIN HAJI MAT TASI

It is hereby certified that we have read this thesis entitled "High Panel Exploitation of *Hevea brasiliensis* (Muell. Arg.): A Comparative Study of Five Tapping Systems" by Ahmad Zarin bin Haji Mat Tasi, and in our opinion it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirements for the degree of Master of Agricultural Science.

....
ALANG P. ZAINUDDIN, Ph. D.
Assoc. Professor/Dean of Graduate Studies
Universiti Pertanian Malaysia
(Chairman Board of Examiners)

....
P'NG TAT CHIN, Ph. D.
Manager of Agricultural Research
Guthrie Research Station,
Seremban
(External Examiner)

....
WONG KAI CHOO, Ph. D.
Assoc. Professor, Dept. of Agronomy & Horticulture
Faculty of Agriculture
Universiti Pertanian Malaysia
(Internal Examiner)

....
WAN CHEN KEONG, Ph. D.
Assoc. Professor, Dept. of Agronomy & Horticulture
Faculty of Agriculture
Universiti Pertanian Malaysia
(Internal Examiner/Supervisor)

This thesis was submitted to the Senate of Universiti Pertanian Malaysia and was accepted as partial fulfilment of the requirements for the degree of Master of Agricultural Science.

ALANG P. ZAINUDDIN, Ph. D.
Associate Professor/
Dean of Graduate Studies

Date: 10 MAR 1988

HIGH PANEL EXPLOITATION OF *HEVEA BRASILIENSIS* (MUELL. ARG.): A COMPARATIVE STUDY OF FIVE TAPPING SYSTEMS

by

Ahmad Zarin bin Haji Mat Tasi

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Supervisor: Associate Professor Dr. Wan Chee Keong

Faculty : Agriculture

High panel exploitation of Hevea using five different tapping systems was studied. Upward tapping on a quarter-spiral cut every third day for eight months, followed by base panel tapping for four months gave a higher yield per tapper but not in terms of total yield per hectare compared to downward ladder tapping on half-spiral cut (control). However, the dry rubber content of the latex was lower; the time taken to tap per tree was less; and stimulant and bark consumption were lower. The Jebong knife or CUT knife used for upward tapping on on a quarter-spiral cut has no effects on the yield of the latex, but it takes more time to tap a tree with the Jebong knife when the tapping cut reached higher levels. Spillage problem was reduced with a sharp tapping knife.

In upward tapping on a half-spiral cut, the yield per tapper was similar to that of the quarter-spiral cut. However, the yield per hectare was higher, and the dry rubber content of the latex was lower. Also, it took a longer time to tap the tree; bark consumption was greater; and the cost of stimulation were higher compared to the quarter-spiral cut.

There was little difference in yield between micro-x and ladder tapping. Micro-x tapping gave a higher dry rubber content of latex and consumed much less bark, but the stimulation cost was higher and it took a longer time to tap a tree.

There were no differences in the late drip percentage among the five tapping systems studied. Overall incidence of dryness on high panel was low. The highest net revenue was given by the half-spiral upward tapping system over the two year period studied.

Abstrak tesis yang diserahkan kepada Senat Universiti Pertanian Malaysia sebagai memenuhi sebahagian daripada keperluan untuk ijazah Master Sains Pertanian.

EKSPLOITASI TAPAK TOREHAN TINGGI PADA <u>HEVEA BRASILIENSIS</u> (MUELL. ARG.): SATU KAJIAN PERBANDINGAN UNTUK LIMA SISTEM TOREHAN

oleh

Ahmad Zarin bin Haji Mat Tasi

September 1987

Penyelia: Prof. Madya Dr. Wan Chee Keong

Fakulti : Pertanian

Eksploitasi tapak torehan tinggi pada Hevea dengan menggunakan lima sistem torehan dikajiselidik. Torehan menaik pada suku lilitan untuk selama lapan bulan, diikuti dengan torehan biasa pada tapak torehan bawah selama empat bulan memberikan hasil yang tinggi bagi setiap penoreh tetapi hasil sehektar yang sama dibandingkan dengan torehan hala ke bawah setengah lilitan menggunakan tangga (kawalan). Bagaimanapun, kandungan getah kering lateksnya adalah rendah; masa yang pendek diambil untuk menoreh setiap pokok; dan kos penggalak yang rendah dan kadar penggunaan kulit juga rendah.

Pisau Jebong atau pisau CUT yang digunakan untuk torehan menaik pada suku lilitan didapati tidak memberi sebarang kesan dari segi penghasilan, tetapi ianya mengambil masa yang lama

untuk menoreh dengan pisau Jebong apabila alur torehan meningkat ke paras yang tinggi. Masalah lelehan dapat dikurangkan dengan penggunaan pisau torehan yang tajam.

Bagi torehan menaik pada setengah lilitan, hasil bagi setiap penoreh adalah sama jika dibandingkan dengan alur torehan suku lilitan. Manakala hasil sehektar adalah lebih tinggi, dan kandungan getah keringnya adalah lebih rendah. Juga, ia mengambil masa yang lama untuk menoreh setiap pokok; penggunaan kulitnya tinggi; dan kos penggalakan juga lebih tinggi.

Terdapat sedikit sahaja perbezaan dari hasil antara torehan mikro-x dan torehan menggunakan tangga. Mikro-x memberikan kandungan getah kering yang tinggi dan kurang penggunaan kulitnya, tetapi kos penggalakan adalah lebih tinggi dan masa yang diambil untuk menoreh setiap pokok adalah lebih lama.

Tidak terdapat perbezaan dalam peratus lelehan lewat bagi kelima-lima sistem torehan yang dikaji itu. Keseluruhan peratus kejadian kering kulit pada tapak torehan tinggi adalah rendah. Keuntungan penorehan yang paling tinggi adalah diberikan oleh sistem torehan separuh lilitan dalam jangka masa dua tahun.

CHAPTER I

INTRODUCTION

Many tapping systems have been developed since the discovery of the excision method of tapping by Ridley in 1889. The results of numerous studies (Dijkman, 1951; Ng *et al.*, 1965, 1970) showed that there is no one tapping system best suited for all clones under all conditions. However, general recommendations for tapping the rubber (*Hevea brasiliensis*) tree at various stages of its life have been made and published by several workers (Rubber Research Institute Malaya, 1959b, 1963; Abraham and Ismail, 1983).

The tapping panel is defined as the area of bark of the rubber tree in which the tapping cut is located. The rubber tree trunk is usually divided vertically into two halves when it reaches maturity for tapping. The first tapping cut is normally made at a height of 80 or 160 cm from ground level depending on whether it is a seedling or a budded tree. This is known as the low or base tapping panel (see page 10 for details on tapping panels). When the bark of the base panel is no longer economical to tap than the tapping cut is made at a higher level on the tree. Generally, this stage is reached when the first renewed bark of the base panel has been completely tapped. The new tapping cut is made on virgin bark above the base panel at a height of 250 - 300 cm from ground level in case of downwards tapping. This is commonly referred to as tapping the rubber tree on high panel or high panel exploitation.

Two basic excision systems of tapping have been used to exploit the rubber tree on high panels. One is to tap downwards with the aid of a ladder as in ladder tapping (Wright, 1912; Rubber Research Institute Malaya, 1954b, 1959a; Selby, 1970), and the other is to tap upwards from ground level without using a ladder (Sharp, 1945; Rubber Research Institute Malaya, 1970). Generally, the number of trees a tapper can tap (task size) in ladder tapping is greatly reduced (Rubber Research Institute Malaya, 1954b) because of the need to carray the ladder from tree to tree, and then climb on it in order to tap the tree. Another disadvantage of ladder tapping is the decline in yield as the tapping cut approaches the renewed bark (Dijkman, 1951). Other problems related to ladder tapping are heavy bark consumption and the reluctance of older tappers to do ladder tapping. Upward tapping of the high panel has been shown to give higher yields than ladder tapping (Rubber Research Institute Malaya, 1970), but is inconvenient and difficult for workers to maintain a good standard of tapping. Bark consumption and latex spillage are high in upward tapping.

A practical and simple technique of upward tapping - Controlled Upward Tapping (CUT) was developed by the Rubber Research Institute of Malaysia (P'ng et al., 1976). A modified gouge was developed for the purpose. It was shown that upward tapping on a quarter-spiral cut (1/4S) together with yield stimulation had several advantages compared to ladder tapping on base panel. Amongst the advantages obtained were a better yield was sustained for a longer period of time, and it provided better control of bark consumption. Cho et al. (1981) reported that considerable areas in Peninsular Malaysia have adopted the CUT system but with numerous alterations. They also noted that several types of knives have been used for upward tapping. However, in South Johore it has been observed that downward tapping with the aid of a ladder is still being practised by a number of estates. In areas where the CUT system is adopted the Jebong tapping knife is used instead of the modified gouge.

In view of the above practice this study was initiated to compare five tapping systems on the high panel and to examine in more detail the practical problems associated with them.

CHAPTER II

REVIEW OF LITERATURE

TAPPING OF *HEVEA*

Tapping is the act of severing the latex vessels in a rubber (*Hevea brasiliensis*) tree by removing a thin shaving of bark or puncture made into its trunk. The aim is to allow a free flow of latex from the vessels. Latex vessels are found in the phloem region occuring in a network formation and are arranged in concentric cylinders in the bark (tissue external to the cambium) (Bobilioff, 1923; Rubber Research Institute Malaya, 1953; Gomez, 1982).

In the early days, latex was extracted from the *Hevea* tree by making a series of cuts on the trunk with a machete (Palhamus, 1962; Wycherley, 1964). This is basically an incision method of extracting latex whereby the bark is not deliberately removed. The method was found to be very damaging as the regenerated bark tissue cannot be tapped again. As a result the economic life span of the rubber tree was considerably shortened.

The search for a more effective and economical way to exploit the *Hevea* tree started in the late 19th century in order to meet the rising demand for natural rubber by the world market. It was Ridley, Director of Singapore Botanical Gardens, who discovered the innovative continuous excision method of tapping the rubber tree in 1889 (Ridley, 1890). In his method, the same latex vessels are repeatedly opened by the removal of a thin shaving of bark from a sloping cut. It avoided damage to the cambium of the tree, and allowed the regenerated bark tissue to be tapped again.

Many tapping systems have since been devised based on the continuous excision method discovered by Ridley. However, the ideal system would be the one which gives the highest yield at the lowest tapping costs, satisfactory growth and bark renewal, and lowest incidence of brown bast disease (Rubber Research Institute Malaya, 1954a; Edgar 1958; Baptiste, 1962). In other words, the basic aim of a good tapping system is to extract the maximum amount of latex from the tree with the minimum damage and retardation to its growth. The results from numerous studies (Dijkman, 1951; Ng *et al*., 1965, 1969, 1970) showed that there is no one system suitable for all clones under all conditions. Instead, general recommendations for exploitation for the rubber tree at various stages of its maturity have been made (Rubber Research Institute Malaya, 1959b, 1963; Abraham and Ismail, 1983).

TAPPING NOTATIONS

Symbols or abbreviations have been used by individual to describe the many tapping systems in use. There was no uniformity in their use, and as a results confusion arose as to their actual meanings. Thus, Guest (1939) proposed an international notation for tapping systems to be used by researchers and planters to eliminate the confusion. This was adopted a year later after some amendments were made to the original proposition (Guest, 1940). The notation have since undergone revisions from time to time to meet the latest development in tapping practices (Lukman, 1983).

(a) Old System

The tapping code follows the standard international notation for *Hevea* tapping systems as described by Guest (1940).

The first symbol described the nature of cut. Capital letters "S", "V" and "C" are used to denote that the tree is tapped with a spiral, V or circumference-cut (type of cut not specified) respectively. The number of cuts is indicated by the numeral on the left of the letters if more than one cut is made on a tree at each tapping. The numeral follows the symbol and an oblique represents the fraction of the cut.

e.g.: S/1 = a full spiral cut

2V/2 = two half-V cut

S/3 = a one-third spiral cut

The second symbol represents the frequency of tapping. The small letter 'd' is used to denote day. The numerals after the oblique indicates the interval in days between tappings.

e.g.: d/1 = daily tapping

d/2 = alternate daily tapping

(2 x 2d/4) = two panels each in tapping for 2 days alternately (tapping-cycle of four days)

The relative intensity is a percentage of intensity based on the standard half-spiral alternate daily tapping (S/2, d/2 100 percent). This is calculated by multiplying the fraction of cut and frequency of tapping by a factor of 400.

e.g.: S/2, d/2 = 1/2 x 1/2 x 400 = 100%

S/2, d/4 = 1/2 x 1/4 x 400 = 50%

S/3, d/2 (2 x 2d/4). = 1/3 x 1/2 x 400 = 67%

Example of a full notation

S/2, d/2, 100% = a half-spiral cut tapped alternate daily.

S/3, d/2, 67% = a third-spiral cut tapped alternate daily.

(b) <u>Revised System</u>

The notation in use today is divided into three parts: tapping method, panel description and stimulation. The relative intensity has been deleted. It has been found that it is neither a measure of the physiological stress of the tree nor an economic parameter.

The symbols for the type of cut follow the old system where "S", "V" and "C" continue to be used. In describing the length of cut a fraction is placed preceeding the symbol. The fraction expresses the horizontal length of the cut in relation to the full circumference.

e.g.: Old system	Revised system
S/2	1/2S = one half-spiral cut
C/2	1/2C = one half-circumference cut

If more than one cut is made then numeral is used preceeding it. For example, if there are two cuts then it is written as 2 x 1/2S (two half-spiral cuts). Direction of tapping is indicated by an arrow (↑). This is only used in upward tapping. The arrow is written immediately after the symbol representing type of cut, e.g. 1/2S meaning one half-spiral cut tapping upwards (Lukman, 1983).

The notation for frequency of tapping remains unchanged. However, additional notation may be placed after the symbols. These notations describe fully the frequency with periodicity and/or change over.

The notation of 'periodicity' may consist of one or more fractions in units of time - weeks (w); months (m); and years (y). The numerator of each fraction denotes the tapping period and may be with or without numeral before the symbol while the denominator of each fraction denotes the length of the cut cycle (tapping period and rest). Each succeeding fraction in the 'periodicity' notation modifies the period of operation of the previous fraction, the denominator of the final fraction gives the full cyclic period of the system. For example, d/2 6d/7 3w/4 8m/12 meaning alternate daily tapping, six days in seven for three weeks in four, during eight months out of twelve (alternate daily tapping for six days followed by one day rest, for each of three weeks followed by one week of rest, during eight months followed by four months of rest).

The tapping of a tree may be done continuously on one panel or on more than one panel. Alternately, the panels can be tapped on alternate days or on alternate periods. This second method called the "change-over system" is denoted by the cycle of changes of each tapping panel given in brackets (Lukman, 1983). The first figure in brackets indicates the cycle of change of the first tapping panel and the second figure indicates the cycle of change of the second tapping panel. A comma is inserted between the cycle of change of the tapping panels. The cycle of tapping is denoted by t (tapping), w (week), m (month) and y (year). For example, (t,t) meaning two cuts, each tapped alternately at every tapping; (8m,4m) meaning two cuts, the first cut tapped in eight months followed by the second cut taped in four months. All these are called the 'change-over symbols' which follows immediately after actual frequency.

Example: d/2 (t,t) = alternate-daily tapping, two cuts, each tapped alternatively on every tapping day.

1/4S d/3, 1/2S (8m,4m) = one quarter-spiral cut tapped upward on third daily tapping for eight months followed by the second cut on half-spiral tapped downwards on third daily tapping for four months.

Tapping panel is represented by a symbol or a series of symbols which describes its location and panel renewal succession. The symbols is not included in the writing of the tapping notation. However, it is usually indicated in the tapping description or treatment details (Abraham and Ismail, 1983). The panel located above the height of the first tapping cut is called the 'high panel' and is denoted by the capital letter H (high). The panel formed below this is considered the 'base panel', and the letter B is used to denote it. Panel renewal succession in relation to the progress of tapping is considered for 'virgin bark' and 'renewed bark'. Virgin bark is denoted by the letter O; the first renewed bark by the numeral I; and the second remewal bark by the numeral II. For example, BI-2 means tapping the second panel on first renewed bark (I), of the base panel (B). HO-I means tapping the first panel on virgin bark (O) of the high panel (H). (See Appendix A for details on succession of panels in the recommended procedure for exploitation of the tree).